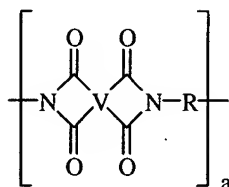


CLAIMS:

1. A process to prepare a polyimide comprising structural units of the formula



wherein "a" has a value of greater than 1, V is a tetravalent linker, and R is a substituted or unsubstituted divalent organic radical,

which process comprises reacting an organic diamine monomer having a molecular weight from 100 to 500 with an aromatic dianhydride monomer with a molecular weight from 218 to 1000 wherein the molecular weight of the polyetherimide is controlled by addition of an aromatic monoamine capping agent of molecular weight 93 to 250;

wherein said polyimide comprises less than 5 wt.% of impurities based on the weight of the polyimide, said impurities having a molecular weight of less than about 500 daltons and comprising structural units derived from at least one monomer unit or from at least one aromatic monoamine.

2. The process of claim 1 wherein said impurities comprise the reaction product one mole of aromatic dianhydride monomer with two moles of aromatic monoamine.

3. The process of claim 1 wherein the organic diamine, the aromatic dianhydride and the aromatic monoamine capping agent are essentially free of benzylic protons.

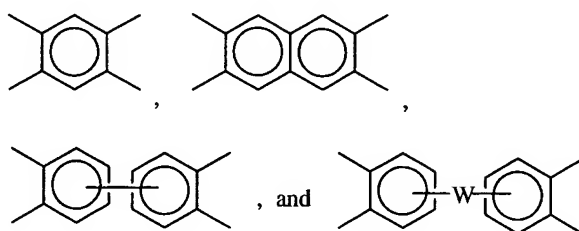
4. The process of claim 1 wherein the polyimide is a polyetherimide.

5. The process of claim 4 wherein the polyetherimide has weight average molecular weight of from 10,000 to 60,000.

6. The process of claim 4 wherein the polyetherimide has a glass transition temperature of greater than or equal to 200 °C.

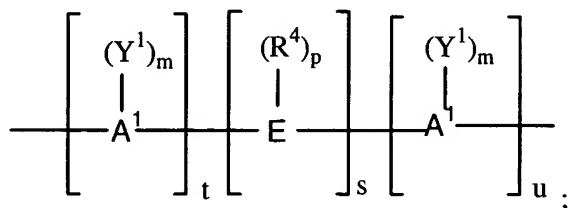
7. The process of claim 1 wherein the tetravalent linker comprises: (a) substituted or unsubstituted, saturated, unsaturated or aromatic monocyclic or polycyclic groups having about 5 to about 50 carbon atoms, (b) substituted or unsubstituted, linear or branched, saturated or unsaturated alkyl groups having 1 to about 30 carbon atoms; or combinations thereof.

8. The process of claim 1 wherein the tetravalent linker comprises structural units of the formulas selected from the group consisting of



wherein W is a divalent moiety selected from the group consisting of -O-, -S-, -C(O)-, -SO₂-, C_yH_{2y}- (y being an integer from 1 to 5), and halogenated derivatives thereof, or a group of the formula -O-Z-O- wherein "Z" is a divalent aromatic group.

9. The process of claim 8 wherein "Z" has the formula:

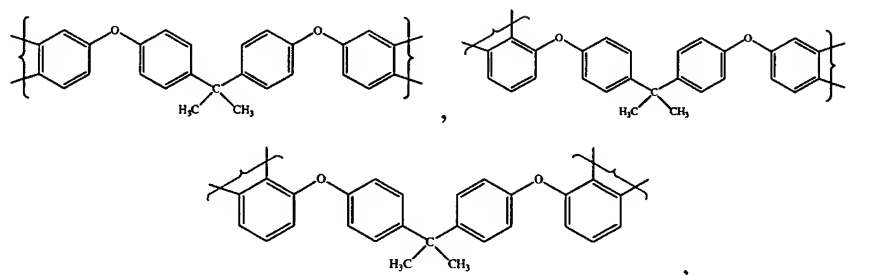


wherein A¹ is an aromatic group, E is an alkylene, an alkylidene, a cycloaliphatic group; a sulfur-containing linkage, a phosphorus-containing linkage; an ether linkage, a carbonyl group, a tertiary nitrogen group, or a silicon-containing linkage; Y¹ independently at each occurrence is selected from the group consisting of a monovalent hydrocarbon group, alkenyl, allyl, halogen, bromine, chlorine; and

nitro; wherein “m” represents any integer from and including zero through the number of positions on A¹ available for substitution; R⁴ independently at each occurrence is a monovalent hydrocarbon group, wherein “p” represents an integer from and including zero through the number of positions on E available for substitution; “t” represents an integer equal to at least one; “s” represents an integer equal to either zero or one; and “u” represents any integer including zero.

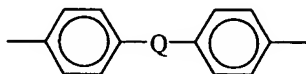
10. The process of claim 9 wherein “E” is a moiety selected from the group consisting of cyclopentylidene, cyclohexylidene, 3,3,5-trimethylcyclohexylidene, methylcyclohexylidene, neopentylidene, cyclododecylidene, adamantylidene, isopropylidene, bicyclo[2.2.1]hept-2-ylidene, 1,7,7-trimethylbicyclo[2.2.1]hept-2-ylidene, C=CZ₂, wherein each Z is hydrogen, chlorine, or bromine, subject to the provision that at least one Z is chlorine or bromine; and mixtures of the foregoing moieties.

11. The process of claim 1 wherein the moiety “V” comprises structural units selected from the group consisting of the formulas:



and mixtures thereof.

12. The process of claim 1 wherein the moiety R comprises at least one of: (a) aromatic hydrocarbon radicals having about 6 to about 20 carbon atoms or halogenated derivatives thereof; (b) straight or branched chain alkylene radicals having about 2 to about 20 carbon atoms; (c) cycloalkylene radicals having about 3 to about 20 carbon atoms, or (d) divalent radicals of the general formula



wherein Q comprises a divalent moiety selected from the group consisting of a covalent bond, -O-, -S-, -C(O)-, -SO₂-, C_yH_{2y}-, and halogenated derivatives thereof, wherein y is an integer from 1 to 5.

13. The process of claim 1 wherein the organic diamine comprises an aromatic hydrocarbon radical.

14. The process of claim 1 wherein the organic diamine is an aromatic diamine with a molecular weight from 108 to 200.

15. The process of claim 1 wherein the organic diamine further comprises functionality selected from the group consisting of ethers, alkoxys, aryloxys, sulfones, perfluoro alkyl groups, and mixtures thereof.

16. The process of claim 1 wherein the organic diamine is at least one diamine selected from the group consisting of meta-phenylene diamine, para-phenylene diamine, 4,4'-oxydianiline, 3,4'-oxydianiline, 3,3'-oxydianiline, 1,3-bis(3-aminophenoxy)benzene, 1,3-bis(4-aminophenoxy)benzene, 1,4-bis(4-aminophenoxy)benzene, 3,3'-diaminodiphenylsulfone, 4,4'-diaminodiphenylsulfone, bis(4-(4-aminophenoxy)phenyl)sulfone, bis(4-(3-aminophenoxy)phenyl)sulfone, 4,4'-bis(3-aminophenoxy)biphenyl, 4,4'-bis(4-aminophenoxy)biphenyl, 2,2'-bis(4-(4-aminophenoxy)phenyl)propane, 2,2-bis[4-(4-aminophenoxy)phenyl]hexafluoropropane, 4,4'-bis(aminophenyl)hexafluoropropane, 3,3'-diaminobenzophenone, 4,4'-diaminodiphenyl ether, benzidine, 3,3'-dimethoxybenzidine, 4,4'-diaminodiphenylsulfide, 2,2'-bis(4-aminophenyl)propane, bis(aminophenoxy) fluorene, diaminobenzanilide and mixtures thereof.

17. The process of claim 1 wherein the aromatic dianhydride monomer has a molecular weight from 300 to 700.

18. The process of claim 1 wherein the aromatic dianhydride monomer further comprises functionality selected from the group consisting of ethers, alkoxys, aryloxys, sulfones, perfluoro alkyl groups and mixtures thereof.

19. The process of claim 1 wherein the aromatic dianhydride is at least one species selected from the group consisting of diphenyl sulfone tetracarboxylic dianhydride, diphenyl sulfide tetracarboxylic dianhydride, hydroquinone diphthalic anhydride, resorcinol diphthalic anhydride, 2,2-bis(4-(3,4-dicarboxyphenoxy)phenyl)propane dianhydride; 4,4'-bis(3,4-dicarboxyphenoxy)diphenyl ether dianhydride; 4,4'-bis(3,4-dicarboxyphenoxy)diphenyl sulfide dianhydride; 4,4'-bis(3,4-dicarboxyphenoxy)benzophenone dianhydride; 4,4'-bis(3,4-dicarboxyphenoxy)diphenyl sulfone dianhydride; 2,2-bis([4-(2,3-dicarboxyphenoxy)phenyl]propane dianhydride; 4,4'-bis(2,3-dicarboxyphenoxy)diphenyl ether dianhydride; 4,4'-bis(2,3-dicarboxyphenoxy)diphenyl sulfide dianhydride; 4,4'-bis(2,3-dicarboxyphenoxy)benzophenone dianhydride; 4,4'-bis(2,3-dicarboxyphenoxy)diphenyl sulfone dianhydride; 4-(2,3-dicarboxyphenoxy)-4'-3,4-dicarboxyphenoxy)diphenyl-2,2-propane dianhydride; 4-(2,3-dicarboxyphenoxy)-4'-(3,4-dicarboxyphenoxy)diphenyl ether dianhydride; 4-(2,3-dicarboxyphenoxy)-4'-(3,4-dicarboxyphenoxy)diphenyl sulfide dianhydride; 4-(2,3-dicarboxyphenoxy)-4'-(3,4-dicarboxyphenoxy)benzophenone dianhydride, 4-(2,3-dicarboxyphenoxy)-4'-(3,4-dicarboxyphenoxy)diphenyl sulfone dianhydride, bisphenol-A dianhydride, benzophenone dianhydride, pyromellitic dianhydride, biphenylene dianhydride, oxydiphthalic anhydride and mixtures thereof.

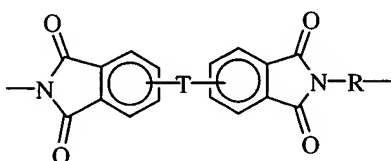
20. The process of claim 1 wherein the aromatic monoamine capping agent comprises about 3 to about 24 ring carbon atoms.

21. The process of claim 1 wherein the aromatic monoamine is selected from the group consisting of: substituted and unsubstituted anilines, substituted and unsubstituted naphthyl amines, and substituted and unsubstituted heteroaryl amines, wherein substituents comprise aryl groups, alkyl groups, arylalkyl groups, sulfone groups, ester groups, amide groups, halogens, alkyl- or aryl-halogen groups, alkyl ether groups, aryl ether groups, or aryl keto groups bound to the aromatic ring.

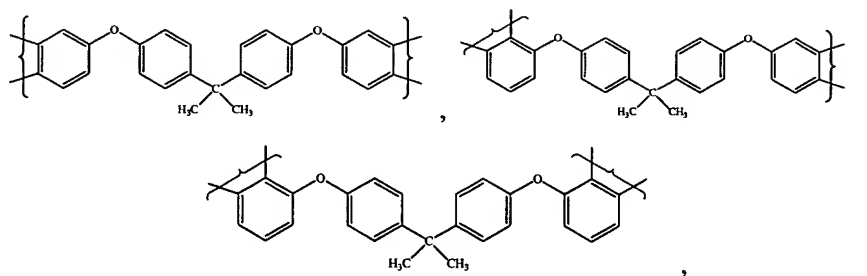
22. The process of claim 1 wherein the aromatic monoamine is used in the process at a level of 0.1 to 15.0 mole % based on the total amine content.

23. The process of claim 1 wherein the aromatic monoamine and organic diamine monomer are intimately combined and added together to the reaction mixture comprising aromatic dianhydride.

24. A process to prepare a polyetherimide comprising structural units of the formula



wherein T is -O- or a group of the formula -O-Z-O- wherein the divalent bonds of the -O- or the -O-Z-O- group are in the 3,3', 3,4', 4,3', or the 4,4' positions, and wherein Z is a divalent aromatic group selected from the group consisting of the formulas:



and mixtures thereof,

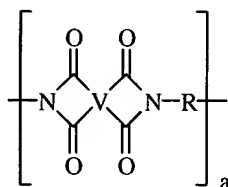
which process comprises reacting an organic diamine monomer having a molecular weight from 100 to 500 with an aromatic dianhydride monomer, wherein the molecular weight of the polyetherimide is controlled by addition of an aromatic monoamine capping agent of molecular weight 93 to 250,

wherein said polyetherimide comprises less than 5 wt.% of impurities based on the weight of the polyetherimide, said impurities having a molecular weight

of less than about 500 daltons and comprising structural units derived from at least one monomer unit or from at least one aromatic monoamine.

25. The process of claim 24 wherein the aromatic monoamine and organic diamine monomer are intimately combined and added together to the reaction mixture comprising aromatic dianhydride.

26. A polyimide composition comprising structural units of the formula



wherein "a" has a value of greater than 1, V is a tetravalent linker, and R is a substituted or unsubstituted divalent organic radical,

said structural units being derived from an organic diamine monomer having a molecular weight from 100 to 500 and an aromatic dianhydride monomer with a molecular weight from 218 to 1000, said polyimide further comprising structural units derived from an aromatic monoamine capping agent of molecular weight 93 to 250;

wherein said polyimide comprises less than 5 wt.% of impurities based on the weight of the polyimide, said impurities having a molecular weight of less than about 500 daltons and comprising structural units derived from at least one monomer unit or from at least one aromatic monoamine.

27. The composition of claim 26 wherein said impurities comprise the reaction product one mole of aromatic dianhydride monomer with two moles of aromatic monoamine.

28. The composition of claim 26 wherein the organic diamine, the aromatic dianhydride and the aromatic monoamine capping agent are essentially free of benzylic protons.

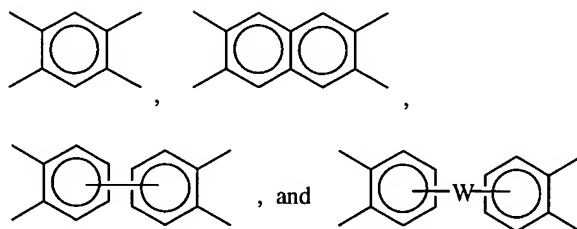
29. The composition of claim 26 wherein the polyimide is a polyetherimide.

30. The composition of claim 29 wherein the polyetherimide has weight average molecular weight of from 10,000 to 60,000.

31. The composition of claim 29 wherein the polyetherimide has a glass transition temperature of greater than or equal to 200 °C.

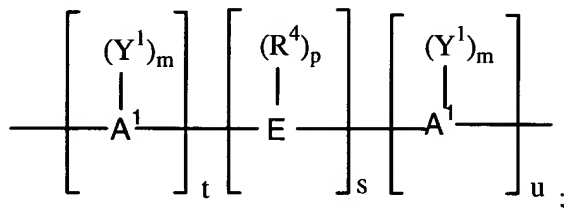
32. The composition of claim 26 wherein the tetravalent linker comprises (a) substituted or unsubstituted, saturated, unsaturated or aromatic monocyclic or polycyclic groups having about 5 to about 50 carbon atoms, (b) substituted or unsubstituted, linear or branched, saturated or unsaturated alkyl groups having 1 to about 30 carbon atoms; or combinations thereof.

33. The composition of claim 26 wherein the tetravalent linker comprises structural units of the formulas selected from the group consisting of



wherein W is a divalent moiety selected from the group consisting of -O-, -S-, -C(O)-, -SO₂-, C_yH_{2y}- (y being an integer from 1 to 5), and halogenated derivatives thereof, or a group of the formula -O-Z-O- wherein "Z" is a divalent aromatic group.

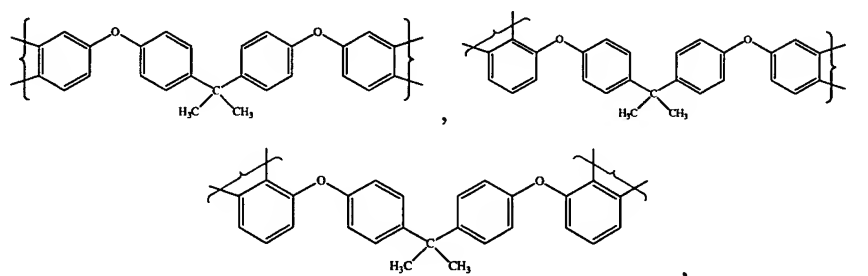
34. The composition of claim 33 wherein "Z" has the formula:



wherein A^1 is an aromatic group, E is an alkylene, an alkylidene, a cycloaliphatic group; a sulfur-containing linkage, a phosphorus-containing linkage; an ether linkage, a carbonyl group, a tertiary nitrogen group, or a silicon-containing linkage; Y^1 independently at each occurrence is selected from the group consisting of a monovalent hydrocarbon group, alkenyl, allyl, halogen, bromine, chlorine; and nitro; wherein “m” represents any integer from and including zero through the number of positions on A^1 available for substitution; R^4 independently at each occurrence is a monovalent hydrocarbon group, wherein “p” represents an integer from and including zero through the number of positions on E available for substitution; “t” represents an integer equal to at least one; “s” represents an integer equal to either zero or one; and “u” represents any integer including zero.

35. The composition of claim 34 wherein “E” is a moiety selected from the group consisting of cyclopentylidene, cyclohexylidene, 3,3,5-trimethylcyclohexylidene, methylcyclohexylidene, neopentylidene, cyclododecylidene, adamantylidene, isopropylidene, bicyclo[2.2.1]hept-2-ylidene, 1,7,7-trimethylbicyclo[2.2.1]hept-2-ylidene, $C=CZ_2$, wherein each Z is hydrogen, chlorine, or bromine, subject to the provision that at least one Z is chlorine or bromine; and mixtures of the foregoing moieties.

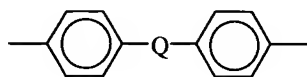
36. The composition of claim 26 wherein the moiety “V” comprises structural units selected from the group consisting of the formulas:



and mixtures thereof.

37. The composition of claim 26 wherein the moiety R comprises at least one of: (a) aromatic hydrocarbon radicals having about 6 to about 20 carbon atoms

and halogenated derivatives thereof; (b) straight or branched chain alkylene radicals having about 2 to about 20 carbon atoms; (c) cycloalkylene radicals having about 3 to about 20 carbon atoms, or (d) divalent radicals of the general formula



wherein Q comprises a divalent moiety selected from the group consisting of a covalent bond, -O-, -S-, -C(O)-, -SO₂-, C_yH_{2y}-, and halogenated derivatives thereof, wherein y is an integer from 1 to 5.

38. The composition of claim 26 wherein the organic diamine comprises an aromatic hydrocarbon radical.

39. The composition of claim 26 wherein the organic diamine is an aromatic diamine with a molecular weight from 108 to 200.

40. The composition of claim 26 wherein the organic diamine further comprises functionality selected from the group consisting of ethers, alkoxys, aryloxys, sulfones, perfluoro alkyl groups and mixtures thereof.

41. The composition of claim 26 wherein the organic diamine is at least one diamine selected from the group consisting of meta-phenylene diamine, para-phenylene diamine, 4,4'-oxydianiline, 3,4'-oxydianiline, 3,3'-oxydianiline, 1,3-bis(3-aminophenoxy)benzene, 1,3-bis(4-aminophenoxy)benzene, 1,4-bis(4-aminophenoxy)benzene, 3,3'-diaminodiphenylsulfone, 4,4'-diaminodiphenylsulfone, bis(4-(4-aminophenoxy)phenyl)sulfone, bis(4-(3-aminophenoxy)phenyl)sulfone, 4,4'-bis(3-aminophenoxy)biphenyl, 4,4'-bis(4-aminophenoxy)biphenyl, 2,2'-bis(4-(4-aminophenoxy)phenyl)propane, 2,2-bis[4-(4-aminophenoxy)phenyl]hexafluoropropane, 4,4'-bis(aminophenyl)hexafluoropropane, 3,3'-diaminobenzophenone, 4,4'-diaminodiphenyl ether, benzidine, 3,3'-dimethoxybenzidine, 4,4'-diaminodiphenylsulfide, 2,2'-bis(4-aminophenyl)propane, bis(aminophenoxy) fluorene, diaminobenzanilide and mixtures thereof.

42. The composition of claim 26 wherein the aromatic dianhydride monomer has a molecular weight from 300 to 700.

43. The composition of claim 26 wherein the aromatic dianhydride monomer further comprises functionality selected from the group consisting of ethers, alkoxys, aryloxys, sulfones, perfluoro alkyl groups and mixtures thereof.

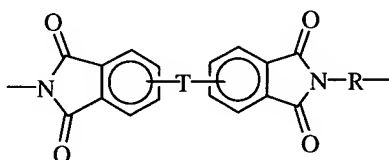
44. The composition of claim 26 wherein the aromatic dianhydride is at least one species selected from the group consisting of diphenyl sulfone tetracarboxylic dianhydride, diphenyl sulfide tetracarboxylic dianhydride, hydroquinone diphthalic anhydride, resorcinol diphthalic anhydride, 2,2-bis(4-(3,4-dicarboxyphenoxy)phenyl)propane dianhydride; 4,4'-bis(3,4-dicarboxyphenoxy)diphenyl ether dianhydride; 4,4'-bis(3,4-dicarboxyphenoxy)diphenyl sulfide dianhydride; 4,4'-bis(3,4-dicarboxyphenoxy)benzophenone dianhydride; 4,4'-bis(3,4-dicarboxyphenoxy)diphenyl sulfone dianhydride; 2,2-bis([4-(2,3-dicarboxyphenoxy)phenyl]propane dianhydride; 4,4'-bis(2,3-dicarboxyphenoxy)diphenyl ether dianhydride; 4,4'-bis(2,3-dicarboxyphenoxy)diphenyl sulfide dianhydride; 4,4'-bis(2,3-dicarboxyphenoxy)benzophenone dianhydride; 4,4'-bis(2,3-dicarboxyphenoxy)diphenyl sulfone dianhydride; 4-(2,3-dicarboxyphenoxy)-4'-(3,4-dicarboxyphenoxy)diphenyl-2,2-propane dianhydride; 4-(2,3-dicarboxyphenoxy)-4'-(3,4-dicarboxyphenoxy)diphenyl ether dianhydride; 4-(2,3-dicarboxyphenoxy)-4'-(3,4-dicarboxyphenoxy)diphenyl sulfide dianhydride; 4-(2,3-dicarboxyphenoxy)-4'-(3,4-dicarboxyphenoxy)benzophenone dianhydride, 4-(2,3-dicarboxyphenoxy)-4'-(3,4-dicarboxyphenoxy)diphenyl sulfone dianhydride, bisphenol-A dianhydride, benzophenone dianhydride, pyromellitic dianhydride, biphenylene dianhydride, oxydiphthalic anhydride, and mixtures thereof.

45. The composition of claim 26 wherein the aromatic monoamine capping agent comprises about 3 to about 24 ring carbon atoms.

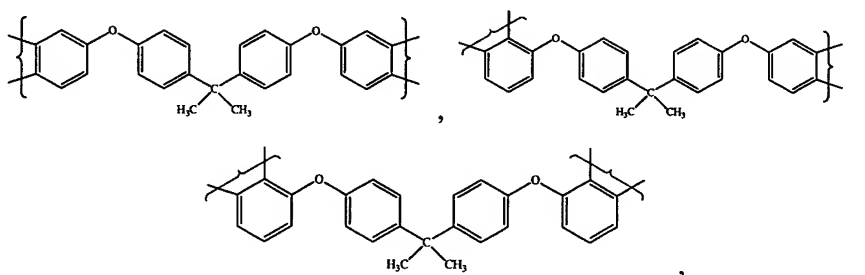
46. The composition of claim 26 wherein the aromatic monoamine is selected from the group consisting of: substituted and unsubstituted anilines, substituted and unsubstituted naphthyl amines, and substituted and unsubstituted heteroaryl amines, wherein substituents comprise aryl groups, alkyl groups, arylalkyl groups, sulfone groups, ester groups, amide groups, halogens, alkyl- or aryl-halogen groups, alkyl ether groups, aryl ether groups, or aryl keto groups bound to the aromatic ring.

47. The composition of claim 26 wherein the aromatic monoamine is used in the process at a level of 0.1 to 15.0 mole % based on the total amine content.

48. A polyetherimide comprising structural units of the formula



wherein T is -O- or a group of the formula -O-Z-O- wherein the divalent bonds of the -O- or the -O-Z-O- group are in the 3,3', 3,4', 4,3', or the 4,4' positions, and wherein Z is a divalent aromatic group selected from the group consisting of the formulas:



and mixtures thereof,

which comprises structural units derived from an organic diamine monomer having a molecular weight from 100 to 500 with an aromatic dianhydride monomer, wherein the molecular weight of the polyetherimide is controlled by addition of an aromatic monoamine capping agent of molecular weight 93 to 250,

wherein said polyetherimide comprises less than 5 wt.% of impurities based on the weight of the polyetherimide, said impurities having a molecular weight of less than about 500 daltons and comprising structural units derived from at least one monomer unit or from at least one aromatic monoamine.

49. An article comprising the composition of claim 26.

50. The article of claim 49 wherein the article is metallized with a reflective coating.

51. The article of claim 49 wherein the article is a selected from the group consisting of: reflectors, connectors, films, sheets, cookware, helmets, medical devices, pumps, trays, food containers, handles, gears, computer parts, appliances, engine components and automotive parts.

52. An article comprising the composition of claim 48.

53. The article of claim 52 wherein the article is metallized with a reflective coating.

54. The article of claim 52 wherein the article is a selected from the group consisting of: reflectors, connectors, films, sheets, cookware, helmets, medical devices, pumps, trays, food containers, handles, gears, computer parts, appliances, engine components and automotive parts.